HOOPER BAY AIRPORT IMPROVEMENTS

PROJECT No. 57419

RECONNAISSANCE STUDY, 2005

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

CENTRAL REGION - DESIGN & CONSTRUCTION
AVIATION DESIGN SECTION
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DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
DESIGN AND CONSTRUCTION
CENTRAL REGION, AVIATION DESIGN

RECONNAISSANCE Study Report

For

Hooper Bay Airport Improvements, 2005
Project No. 57419

2/7/05

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Executive Summary

The existing airport and related facilities at Hooper Bay are in need of repair. The runway is missing approximately 570' of pavement from the center section, the airport access road exists as a footprint and coastal erosion has continued to play a large role in the remaining design life of the existing airport. The existing airport access road experiences flooding during seasonal storm surge events, which isolates the village from the airport. The existing airport could experience a major failure in the next 7-10 years. This report explores alternative solutions for improvements to the Hooper Bay Airport.

This study examines the viability of site alternatives for a regional hub airport recommended by the Yukon-Kuskokwim Delta Transportation Plan using information from various reports and the findings of a field trip conducted specifically for this study. This study identified a need for an interim project to repair the immediate concerns at the airport, namely the damage to the runway and the airport access road. The preliminary cost for the interim project is estimated to be $2,063,684 and has been programmed for construction during the summer of 2005.

This report also explores more permanent solutions to reconstruct or relocate the existing airport. Both of these options locate the airport and its related facilities on higher ground, minimizing snow drifting, which has been a maintenance concern at the existing facility. The estimated reconstruction alternative is estimated to cost $22,149,082. If reconstructed at the existing location, the airport would continue to experience ongoing maintenance concerns associated with coastal erosion. The access road would also have to be built to resist anticipated storm surge events. This reconstruction option would not meet the minimum separation distance recommended by FAA between the runway and the existing sewage lagoons/landfills.

A relocation alternative is estimated to cost $24,319.274. This alternative constructs a new airport on higher ground outside of the flood plain, potentially eliminating the concerns with coastal erosion and storm surge events. The relocation would also be more compatible with future expansion such as a crosswind runway and it would provide the recommended distance from the village and sewage lagoons/landfills.

This report recommends proceeding with project development of permanent improvement solutions for the Hooper Bay Airport. All of the alternatives noted above have been addressed in this study and breakdowns of each cost estimate are located in Appendix V.

Description of Study Area

Hooper Bay is located approximately 20 miles south of Cape Romanzof and 25 miles south of Scammon Bay in the Yukon-Kuskokwim Delta. The city is separated into two sections: a heavily built-up town site located on gently rolling hills and a newer section in the lowlands. It lies at approximately 61.53° North Latitude and 166.10° West Longitude. (Sec. 26, T017N, R093W, Seward Meridian.)

Village Looking West Towards the Existing Airport

Hooper Bay is located in the Bethel Recording District. The area encompasses 8.7 square miles of land and 0.1 square miles of water. The climate in Hooper Bay is considered maritime with a total precipitation of 16 inches and an annual snowfall of 75 inches. Temperatures range between -25 and 79. The Bering Sea is ice-free from late June through October, with winter ice pack and winds often promoting severe conditions.

History and Culture

The village of Hooper Bay was first located in 1878 by E.W. Nelson of the U.S. Signal Service. The U.S. Census taken in 1890 noted 138 people living in 14 homes in the area. At the time Hooper Bay was better known by its Eskimo names "Askinuk" or "Askinaghamiut." The name Hooper Bay became common after the local post office was established in 1934. The present-day name for the village is "Naparyarmiut", which is derived from the Napareayak River.

The native village of Hooper Bay is a federally recognized tribal organization, with the city government becoming incorporated in 1967. It is a large traditional Yu'pik Eskimo community where 95.8% of the population are Alaska Native or part Native. Members of the village of Paimiut also live in Hooper Bay. The population of Hooper Bay has grown from 627 in 1980 at a rate of 2.5% per year to the current 2004 population, estimated by the State Demographer, to be 1,124 people.

Commercial fishing and subsistence activities are the primary means of support, with 47 residents holding commercial fishing permits. Most employment is seasonal with little income producing activity available during the winter. 239 housing units exist with 12 being vacant. 202 residents were employed, with an unemployment rate of 37.3% noting that 65.9% of adults were not in the work force. The median household income was $26,667, while the per capita income was $7,841 noting that 27.9% of residents were living below the poverty level.

Residents of Hooper Bay rely primarily on four wheelers and snow machines as their methods for ground transportation. However, many small lakes and low-lying wet areas within the area limit the number of trails used during the winter. Winter trails presently exist to Scammon Bay (32 mi.), Chevak (20 mi.) and Paimiut (14 mi.). In the summer months, skiffs are also used for transportation outside the village.

A draft long-range transportation plan was developed for the community in 2002 and addresses ground transportation concerns and solutions ranging from short to long-range projects. The plan estimates the number of vehicles in the community to include 8 trucks, 250 four wheelers, 300 snowmachines and 300 skiffs. Barge lines deliver shipments of fuel and other bulk supplies throughout the summer as shown in the picture above.

Purpose & Need

Immediate Concerns

The existing airport facilities have a limited life expectancy due to beach erosion, inland flooding and other mitigating factors. Because of these immediate concerns, an interim project is required before a long-term solution can be implemented. It is recommended that an interim project include a surface treatment for approximately 570' of asphalt pavement missing from the center section of the runway (as shown right).

In addition to the runway surfacing, an interim project should also include a stabilized base for the airport access road (as shown below) to withstand recurring flood events. The airport access road is presently in poor condition and is subject to recurring flood events. The road elevation is approximately 1.5' to 3.5' above mean sea level, while the airport is located on coastal dunes adjacent to the Bering Sea at a higher elevation of approximately 9'. According to locals, the area can be inundated with up to four feet of standing water. In addition to the flooding, the access road also experiences significant wear from

construction vehicles accessing the beach. Historically, the beach has been the main source of embankment for various village improvement projects.

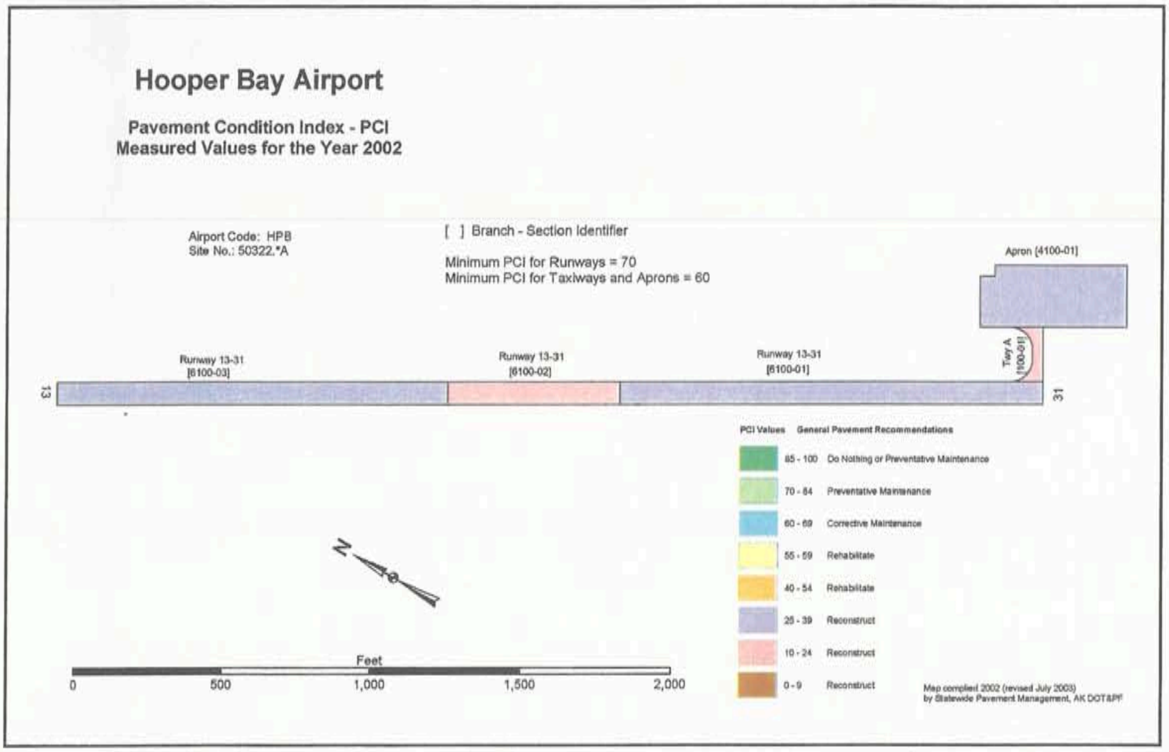
Runway erosion is not as much of an immediate concern as the runway surfacing or the stabilization of the access road, but it is a major factor when considering the remaining useful life of the existing facility. The picture shown below depicts the end of the existing

runway (13). Prior to 1996, the pavement was eroding at an accelerated rate so sheet piling was installed in an attempt to maintain the existing embankment. This photo also shows the ongoing undermining of the surface course located outside the piling. At the apparent erosion rate of 8-feet per year, it is estimated that the erosion will breach the ends of the sheet pile wall in another 7 to 10 years. This timeline limits the design life of the existing facilities and warrants a long-term solution. A cost estimate has been prepared for an interim project as described and is located in Appendix V.

Long Term Need

Aircraft provide the only year-round public transportation service to Hooper Bay. The Yukon Kuskokwim Delta Transportation Plan (Y-K Plan) notes the total enplanements for 2000 at 5,104. This number is anticipated to increase 68% by 2010 for a total of 8,600 and 262% by 2020 for a total of 13,400. Under its present state, the existing facilities would be unable to handle the additional traffic load. The remaining pavement is failing and should be a consideration when evaluating the timeline of future projects.

The runway, taxiway and apron were evaluated in 2002 using the Corps of Engineers Pavement Condition Index (PCI). The graphic shown on the next page summarizes the evaluation.



A perfect, new pavement has a PCI value of 100. Deductions are made for measured pavement distresses so that a completely failed pavement would have a PCI of 0. As indicated in the 2003 PCI report, the average weighted runway PCI for Hooper Bay was 31, while the taxiway and apron scored a 28. As previously shown, all existing pavement falls under the “reconstruct” category.

In addition to the anticipated increase in enplanements, freight, fuel & mail delivery are also anticipated to increase. The Y-K Plan states that just less than 2 million pounds of fourth-class mail was sent to Hooper Bay in 1999. This results in an average of 8 flights a day, 5 days a week all year. Due to current use and future demand, the plan recommends expanding the Hooper Bay runway into a 4500’ sub-regional hub, increasing freight, fuel & mail deliveries. A side benefit of the hub will be to reduce the large subsidies currently being paid on USPS mail contracts.

With the forecast showing increased traffic and the possibility of establishing a mail hub, it is also important to consider the existing runway length when evaluating the need for future airport improvements. The existing runway is 3300’, which falls short of the length recommended by the FAA Airport Design Program (version 4.2D) for small aircraft with 10 or more passenger seats. ERA Aviation & Grant Aviation presently service the village with aircraft meeting this criterion, which justifies the need to extend the runway length with any future airport improvement project.

Two options are available to expand the airport to the recommended mail hub. Long-term solutions include reconstruction of the existing airport or relocation of the airport and its related facilities. Cost estimates have been prepared for both options and have been attached in Appendix V. As with all options, each has its advantages and disadvantages, which will be discussed more in depth in the "design options" section.

Airport Project History

Before 1959, the airport existed as a rudimentary 50' by 1,600' gravel landing strip. In 1959 the runway dimensions were increased to 100' by 4000' (without safety areas) and a sand emulsion surface course was added. In 1972 a road connecting the village to the runway was established and the runway was reconstructed and resurfaced with emulsified asphalt. During the same project, the north edge of the runway was excavated out and interlocking 55-gallon drums were installed and filled with sand to help act as a barrier from the recurring beach erosion. In 1976 a stand-alone project was established to construct the double bay SRE building.

Despite the beach armoring, the north end of the runway eroded to a 3900' useable length. In 1981 the department placed about 550 linear feet of ArmorFlex (concrete matting) to help slow down the erosion until a more permanent solution could be constructed. Sometime after the initial installation, the City of Hooper Bay repaired and extended the ArmorFlex on the north end of the runway to about 1,450 linear feet, replacing or burying the existing drums.

In 1991 an additional 400 linear feet of ArmorFlex was placed further down the beach parallel to the midpoint of the runway (station 22+00 to 26+00) to reduce beach erosion. During this project, the runway was reduced to 75' x 3300' and 300' safety areas were added. The remaining runway was paved with asphalt concrete.

In 1996, the department installed 1000 feet of sheet pile along the north end of the runway (as shown right). Originally designed as a "last defense" to erosion, modifications to the original sheet pile plan moved the wall into a more active wave environment. Because of the design change, the ArmorFlex anchor system was cut after the installation of the

sheet pile and the blocks were left in place to provide scour protection at the toe of the wall. At the time it was thought that these erosion measures would extend the life of the runway as much as 20 years. However, erosion rates at that time were approximated at 3 feet per year. With current approximations at 8 feet per year, it may be necessary to relocate the runway in the near term.

The center section of the runway was reconstructed in 1999 due to pavement failure. Since this project, the pavement has failed again and has been removed until an interim project can be constructed.

Existing Airport Facilities

A 75' by 3300' runway currently exists with a 100' by 3900' safety area. A private hangar currently exists on the 180' by 500' apron, which is connected to the runway by a 35' by 150' taxiway. The picture, shown right, depicts the existing facilities. Medium intensity runway lighting exists along with a lighted wind cone, rotational beacon, AWOS, VASI & segmented circle (currently damaged). Runway 31 also has an Omni Directional Approach Lighting System (ODALS). A 1.5-mile access road connects the village to the apron and a double bay snow removal equipment (SRE) building currently exists off the airport access road. The beach access road spurs off of the airport access road along the south end of the runway. Additional aerial photography has been attached as Appendix II.

Design Options

No-Build Option

Under the no-build option, the existing airport facilities would remain unchanged with no improvements other than routine maintenance. The no-build option would not meet the purpose and need of a potential airport project and is not considered further in this report.

Interim Projects

Interim projects are required in order to keep the existing facilities operational until a future airport improvement project can be constructed. The center section of the existing runway is in emergency need of repair and the airport access road requires a stabilized base to provide a maintainable year round driving surface.

Approximately 560' of asphalt is currently missing from the center of the runway. The exposed subgrade has been degraded and a number of large potholes exist. Air carriers were questioned about the condition of the runway during the June 2004 field trip and most stated that the potholes were a source of concern. After consultation with the DOT/PF Central Region Materials Section, it was recommended that the subgrade be treated with an emulsion treated base course with a single high float application as a surface course. This repair will create a maintainable working surface and extend the life of the runway until a more permanent solution can be constructed.

Another immediate concern is the airport access road. The existing road is in use, but is in major need of repair. As shown below, flooding and storm surge events have eroded nearly all of the useable material from the road, which currently exists as a footprint, with sections falling below the surrounding terrain. Because of these high water events, the interim design prohibits the possibility of building up the road without major erosion protection. For an interim project, this would prove quite costly to construct and difficult to maintain. Because of these concerns it is recommended that the interim project place 1.5' of medium sized aggregate (3" – 8") to provide a shallow solid base that will be resistant to flooding erosion. The low profile will still allow high water events to pass over the road, but will remain in place after the event.

Due to erosional concerns, it is estimated that an interim project would only maintain the existing facilities for an additional 7-10 years. This window should provide an acceptable timeline to design and construct a more permanent solution. A cost estimate for an interim project, which includes the runway and access road repairs has been prepared and is attached as Appendix V.

Long Term Options

The reconstruction of the existing airport should be analyzed as a possible long-term option. Some of the benefits of using the existing facilities include its close proximity to the village in addition to the realized cost savings from the reduced amount of imported material that would be required. Some of the drawbacks associated with this alternative include the lack of property for expansion, beach erosion and coastal flooding.

Wind data was collected and analyzed, as described in the design criteria section of this report, and was found to support the current runway orientation. However, since the optimized orientation fell short of the 95% wind coverage recommended by the FAA, the need for a crosswind runway will have to be evaluated. In the event that a crosswind runway is required, the existing property may prove to be restrictive with respect to certain orientations. These restrictions would not only be related to the allocated property, but would also include the crosswinds proximity to the village and the landfill/sewage lagoon.

Beach erosion is another drawback to reconstructing the existing facilities. The existing runway embankment is currently held in place at its north end by sheet pile. The sheet pile wall was constructed to protect the embankment from erosion caused by tidal influence and storm surge events. The Department's Coastal Engineering Section was consulted and with the apparent erosion rate of 8-feet per year, erosion will have breached the ends of the sheet pile wall in another 7 to 10 years. The picture to the right depicts the sheet pile wall and some of the concrete matting installed during a 1996 project to prevent or slow down the rate of erosion. If erosion slows to the rate of 3 feet per year (historical rate observed from 1951 to 1994), the design life could possibly be extended to 30 years. Using either rate, erosion will prohibit a 50-year design life if the existing airport is reconstructed.

Coastal flooding should also be considered under the reconstruction option. During storm surge events, which on average occur biannually, the airport access road is washed out and isolates the airport from the rest of the village. If the existing airport were reconstructed, the access road would need to withstand overtopping by a 50-year high water event. If reconstruction were selected as a viable option, the feasibility of constructing an access road impervious to such events would need to be evaluated based on the costs of construction and continued maintenance. In summary, the before mentioned concerns may prohibit reconstruction as being the most viable option. A cost estimate was prepared for this alternative, which has been attached as Appendix V. This preliminary estimate was prepared prior to acquiring knowledge of coastal flooding. With this in mind, additional funding will be required to protect the access road and other aspects of the reconstruction from erosion and flooding concerns.

Another possible long-term option would be to relocate the airport to a preferred site. Five potential sites, in addition to the existing airport, were evaluated for feasibility and future design consideration during a reconnaissance field trip to the area on June 23rd, 2004. The locations of these sites can be seen on the USGS map attached as Appendix III.

Sites two, three & four seemed less viable due to topographical considerations (considerable elevation changes, major water bodies and existing ground conditions). The picture shown below depicts a general view of the region. If one of these sites were considered as an alternative, further site investigation would be required to establish the feasibility of constructing and maintaining the airport at that site.

Site five appeared to have potential, but would not necessarily be the best available option. The airport itself could be located on high ground, however it would be located approximately six miles from the village. The length of the access road would prove costly to construct in conjunction with the maintenance due to obstacles such as stream crossings and coastal flooding.

Site one appeared to show the most potential of all the sites. The topography seemed favorable in comparison to the other sites and its proximity to the village would also prove beneficial. One of the best features of this site is the high topography available for an access road. A cost estimate was prepared for this alternative, which has been attached as Appendix V. A beach access road was not included in this estimate since the existing airport access road would provide beach access in the event that the airport is relocated.

Design Criteria

This section discusses the design aircraft, the airport reference code and other design related criteria in support of the general airport layout shown in Appendix I and the cost estimates shown in Appendix V. The following subsections discuss and summarize the proposed differences in primary feature dimensions noted in the following table:

PRIMARY FEATURE DIMENSIONS

Runway 13 – 31	**Near Term**	**Mid Term**	**Ultimate**
Feature	**FEET**	**FEET**	**FEET**
Aircraft Design Group	B-II	B-II	B-III
Runway Length [1]	4500	4500	4500
Runway Width	75	75	100
Runway Safety Area Width	150	150	300
Runway Safety Area Length Beyond Runway Ends	300	300	600
Runway Object Free Area Width	500	500	800
Taxiway Width [2]	50	50	50
Taxiway Safety Area Width [2]	118	118	118
Taxiway Object Free Area Width [2]	186	186	186
RPZ Length	1000	1000	1000
RPZ Inner Width	500	500	500
RPZ Outer Width	700	700	700
Approach Inner Width	500	500	500
Approach Outer Width	3500	3500	3500
Approach Length	10,000	10,000	10,000
Approach Slope Angle	34:1	34:1	34:1

Standards based on FAA Advisory Circular 150/5300-13, Tables 2-4, 3-1, 4-1. Assume Non-Precision Instrument Approach with Visibility Minimums >3/4 Mile. Runway dimensions are based on the main runway (crosswind ultimately possible).

[1] Runway lengths based on Tables 3-14 & 3-17 (Y-K Plan) with the DC-6 as the ultimate design aircraft. Near and mid-term designs utilize the DC-6 as well since it assumed that occasional operations will take place with frequency less than 50 operations per year.

[2] Near & mid-term taxiway designs based on occasional DC-6 use.

The airport embankments will be constructed as an overlay of the existing ground. The existing soil classification and possible material sources will be discussed later in this report.

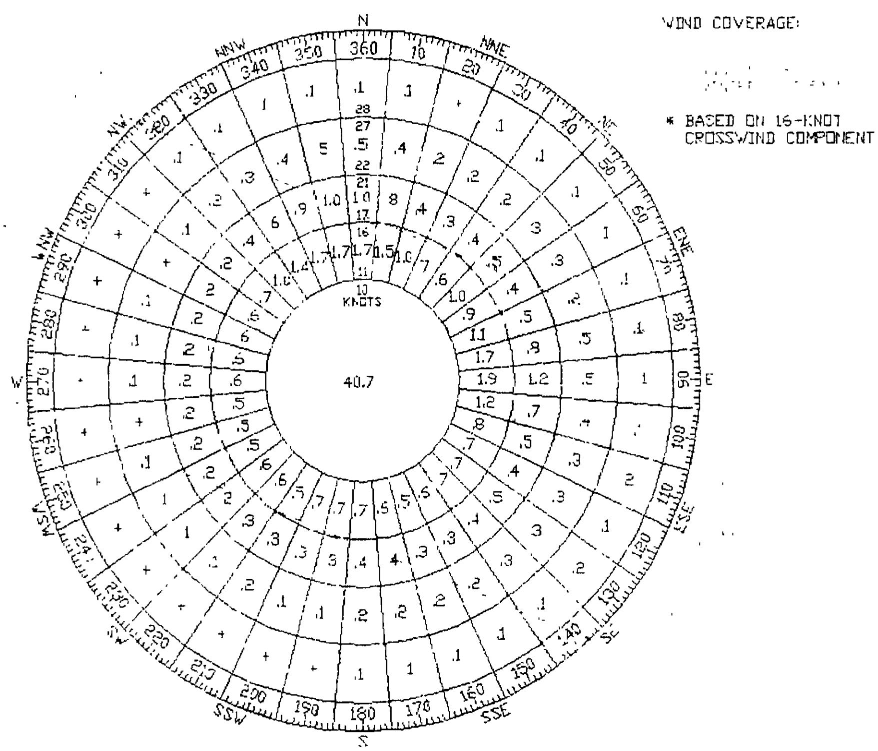
Design Aircraft & Airport Reference Code

According to FAA Advisory Circular 150/5325-4A, Section 1.2.a, a family or group of airplanes should be selected for design aircraft when considering airport size. Hooper Bay is presently served by air taxis operating from Bethel using a variety of aircraft including but not limited to the DeHavilland Twin Otter (DHC-6-300), Piper Navajo (PA-31), Beechcraft 1900 and Cessna Caravan (C-208), the largest of which meet the B-II aircraft design category. However, the Y-K Plan outlines the need to increase the airport to a USPS mail hub, which will ultimately be sized to accommodate large cargo aircraft such as the McDonnell Douglas DC-6 (B-III) flown by Northern Air Cargo and Air Cargo Express.

In the near to mid-term, it is expected that the DC-6 will be used occasionally with less than 50 operations per year. With this in mind it is recommended that the runway length and taxiway dimensions accommodate the occasional use of the DC-6 (B-III aircraft design group), while the rest of the airport follow the B-II aircraft design group until more frequent operations warrant an expansion of the facilities. The following sections apply these choices to the standards proposed for this airport.

Wind Coverage

Wind data was collected from the Hooper Bay automated weather observation station (AWOS) and was obtained through the National Climatic Data Center. The data included wind velocity and direction observations at 1-hour intervals between January 1994 and December 2003. Using this data, wind analyses were performed for runway orientations in accordance with AC 150/5300-13, Appendix 1. The wind rose shown right depicts the annual data overlain with optimized summer (May – October), winter (November – April) & annual orientations (12 month composite).



A 16-knot crosswind component was used for all analyses to accommodate the ultimate B-III design group. The optimized heading based on true north was analyzed using summer, winter & annual wind observations to determine if there was significant seasonal variance. As indicated in the wind rose, the seasonal orientations vary by 61°. It should also be noted that the orientation based on the annual data falls below the FAA recommendation of 95% coverage. This indicates that a crosswind runway should be evaluated in the ultimate design. Due to the seasonal variance, it is unclear at the time of this report what the optimal orientation will be. This will be decided during the design phase of the project.

Proposed Runway

As previously stated, it is recommended that the near and mid-term lengths shall be 4,500', which support the DC-6 aircraft recommended by the Y-K Plan. This length meets and exceeds the length recommended by the design program, "Airport Design for Microcomputers" in AC150/5300-13 for 100% of small aircraft of less than 10 passengers. The ultimate runway length shall remain at 4,500' per the Y-K Plan. As discussed in the wind coverage section above, the need for a crosswind runway will be evaluated in the ultimate design. Runway construction will primarily consist of a silt and sand embankment. The depth of the embankment was designed to minimize snow drifting and assist the surfaces in keeping clear of snow during storm events. Typical section examples and a general airport layout have been included as Appendices IV & I, respectively.

Proposed Taxiway

Two taxiways will be constructed as part of the initial development connecting the runway to the apron. Typical section examples for the proposed taxiway can be found in Appendix IV. The taxiways will meet the ultimate safety area and surfacing widths required for design group B-III standards. Near and mid-term developments will provide the ultimate dimensions to increase operational safety in adverse conditions such as crosswinds over icy surfaces. The embankment height will minimize snow drifting and assist the surfaces in keeping clear of snow during storm events.

Proposed Apron

The proposed apron shall provide an airside parking area of approximately 135,000 square feet. The aviation support side shall also be 135,000 square feet, which will include a total of five 150' by 150' aviation support lots and a 150' by 150' SRE building pad. The combined areas will result in an apron covering an area of 270,000 square feet. DOT/PF Statewide Leasing recommended the proposed aviation support area dimensions to accommodate the postal hub recommended by the Y-K Plan. Near and mid-term development will provide the ultimate B-III design group dimensions to increase operational safety in adverse conditions such as crosswinds over icy surfaces. The proposed apron design will also include the setback required for the B-III design group. The embankment height will minimize snow drifting and assist the surfaces in keeping clear of snow during storm events. Typical section examples for the proposed apron can be found in Appendix IV. Aircraft tie-downs are also proposed for the apron for transient small aircraft.

Proposed Access Road

The airport access road design will be dependent on which site is chosen for the airport improvement project. Due to the possible design challenges at each location, the optimum design is uncertain at the time of this report. In the event that the airport is relocated, the proposed access road design shall be a two-lane road in accordance with the AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads. The embankment height will minimize snow drifting and assist the surfaces in keeping clear of snow during storm events. Typical section examples for the proposed access road can be found in Appendix IV. In the event that the existing airport is reconstructed, the design will have to be evaluated to include annual flood events and washout potential. In the near term, it is recommended that an interim project be constructed to provide better access as described in the Purpose & Need section of this report.

Beach Access Road

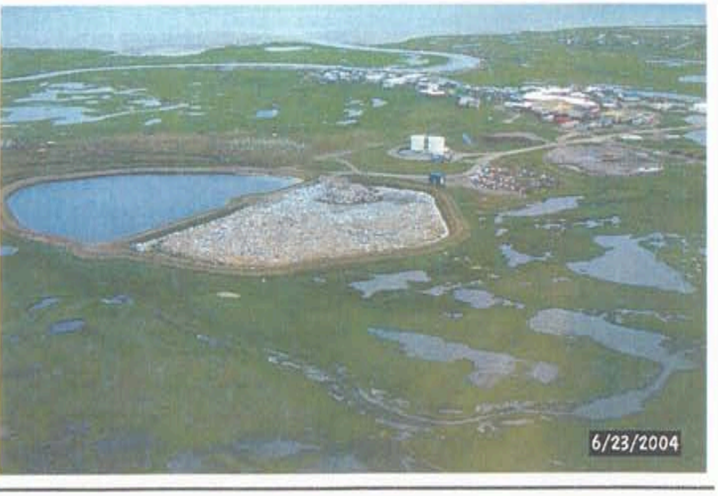
Beach access currently exists as a spur off of the airport access road. In the event that the airport is reconstructed, the access road will follow the typical section example located in Appendix IV. The embankment height will minimize snow drifting and assist the surfaces in keeping clear of snow during storm events. In the event that the airport is relocated, the existing airport access road will allow beach access for the community. The beach has been a major source of material for the village and has historically been used for the gathering of firewood and other cultural activities. Access will be provided regardless of the final design location.

Airport Lighting

The proposed development will include medium intensity lighting to both the runway and taxiways. A lighted wind cone will be installed and a rotating beacon will also be placed on the snow removal equipment (SRE) storage building. Discussion with FAA will be necessary to determine if the existing ODAL's or other approach aids will be included in the final design.

Airport Site Hazards

When designing an airport serving turbine-powered aircraft, the FAA recommends 10,000' minimum separation between the airport and wildlife attractants such as sewage lagoons and landfills per AC150/5200-13. The proposed airport shall provide the recommended distances from the existing attractants as shown right.



Environmental

Wetlands: The area surrounding Hooper Bay is predominantly wetlands. Although all of the potential sites for relocation attempt to maximize elevated topography, all will have some impact on wetlands. Due to the importance of wetlands for a variety of resources (bird habitat, subsistence resources, etc.), minimization and avoidance of impacts to wetlands will be an important consideration for all potential sites.

Fish and Wildlife: Based on knowledge obtained from local residents, blackfish are present in many of the ponds and sloughs throughout the area, therefore a Fish Habitat Permit would be required for any work below ordinary high water (OHW) in a pond or slough containing blackfish. Whitefish are also present in Napareayak Slough, which would also require a Fish Habitat Permit for any work below OHW. National Marine Fisheries Service does not manage these species; therefore Essential Fish Habitat Consultation will not be required.

Numerous species of migratory birds use wetlands areas for nesting; therefore clearing will most likely be prohibited from April 15 - July 15. Impacts of habitat loss to these species will need to be evaluated as well. Consultation with USF&WS will be necessary for impacts to migratory birds. A bird survey may also be required for Stellar's and Spectacled Eiders as described in the following section.

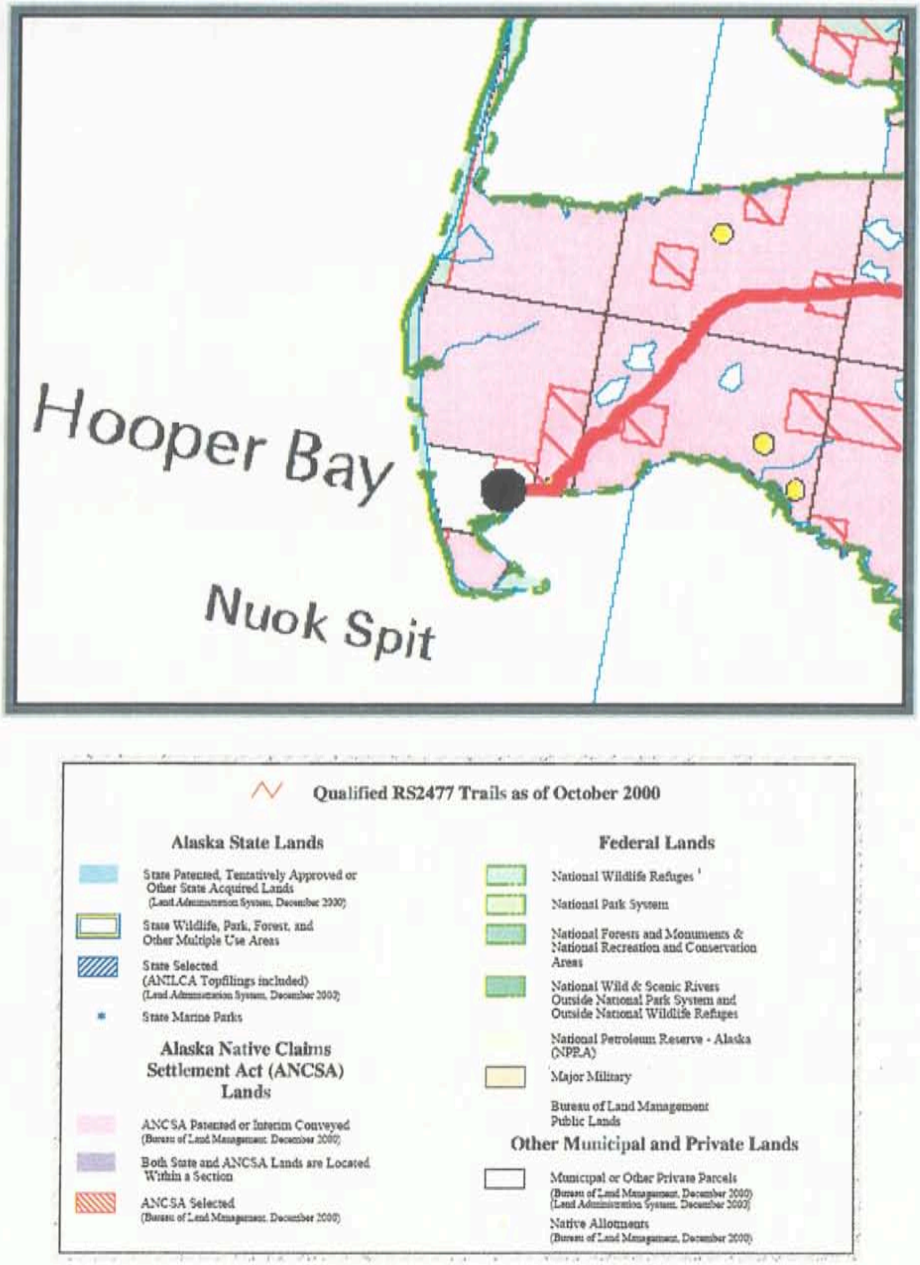
Threatened/Endangered Species: Stellar's Eiders and Spectacled Eiders are both listed as Threatened Species and the north shore of the peninsula that Hooper Bay is located on is designated as critical habitat for these species. Any relocation site would be closer to this critical habitat than the current airport and any site may be considered potential habitat for these species. Ellen Lance, endangered species biologist for U.S. Fish and Wildlife (USFWS), has made the following recommendations:

- Formal consultation will likely be required and should be started at the earliest opportunity.
- A bird survey would likely be required prior to construction to look for any nests in the project area.
- If any nests will be disturbed, a take permit would be required from USF&WS.
- USFWS will also be evaluating the impacts of auxiliary airport features that attract birds (lighting, beacons, etc.)

Cultural Resources: The village of Hooper Bay has existed at or near its present location for several hundred years. The older part of town is considered a historic site and other historic sites have been found north and south of the existing airport. Presently, no known sites are located at or near any of the potential project locations. Due to the long history of habitation in this area and the number of known sites in the general vicinity, a cultural resources survey will be necessary for any new ground disturbed for this project. To date, systematic surveys have not been completed outside of the existing town site.

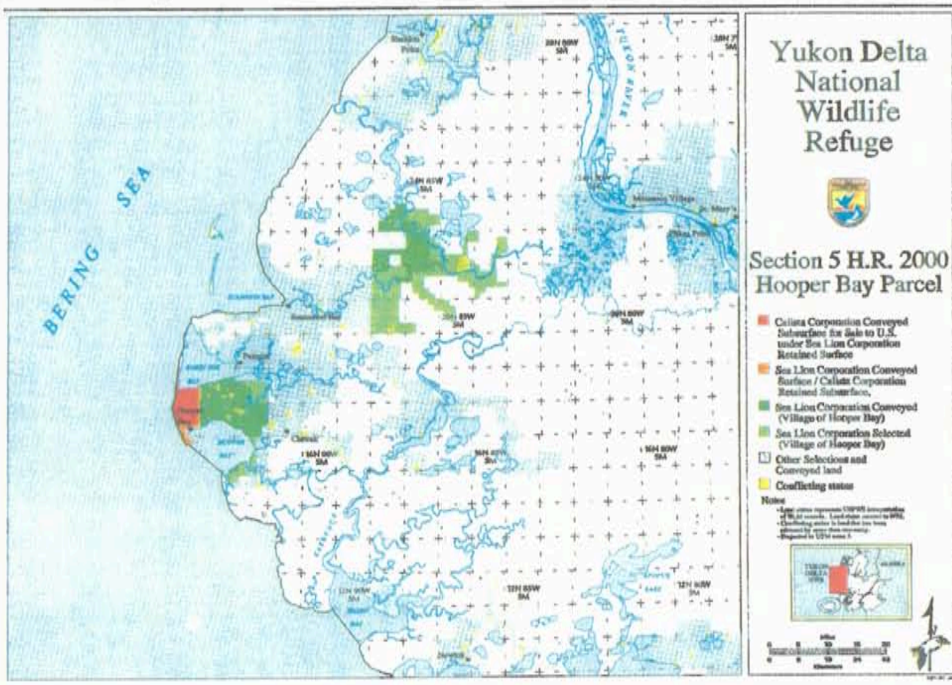
Contaminated Sites/Hazardous Waste: There are no known contaminated or hazardous sites in the greater Hooper Bay area.

Section 4(f)/6(f) Properties: Much of the land surrounding the village of Hooper Bay is owned by the Sea Lion Native Corporation, but falls within the boundaries of the Yukon Delta National Wildlife Refuge. The following graphic shows the land ownership in the Hooper Bay area. Evaluation of this land as a 4(f) resource may be necessary, depending on the terms of the management agreement for this land.



Subsistence Resources: Hooper Bay is located within the Cenaliuriit Coastal Resource Service Area, in which access to and use of subsistence resources is a priority. Based on input from local residents, most of the subsistence resources are located in wetland areas. Since all potential sites are likely to impact wetlands, subsistence resources will need to be evaluated from the impacts of a proposed project. However if the airport is relocated, it is likely that the new airport access road may provide improved access to subsistence resources.

Material Sites: Environmental concerns associated with any potential relocation site will also apply to any material site chosen within the Hooper Bay vicinity. The map shown below depicts the subsurface rights within the Yukon Delta National Wildlife Refuge (limits of the refuge extend beyond the area shown). The USFWS owns subsurface rights north and east of T17N R93W Sections 25,26, and 27; therefore excavation in this area would require a Special Use Permit from USFWS. Calista Corporation owns the subsurface rights to the south and west of this boundary.



Summary of Permit Requirements: The following permits are anticipated to be required for expansion or relocation of the existing airport:

1) <u>Individual 404 Permit</u>: Due to the scale of this project, an individual 404 permit will be required for any fill in wetlands. Per the 2003 Airport Wetlands Memorandum of Agreement (MOA), ADOT&PF will be required to fully assess all impacts to wetlands, and evaluate avoidance and minimization alternatives. Compensation will be required for all unavoidable impacts to wetlands per the MOA. An individual 404 permit can take between three months and two years to obtain.

2) <u>Title 41 Fish Habitat Permit</u>: A Fish Habitat Permit may be required for work below OHW in ponds and sloughs depending on fish species present. This permit will take 30 to 60 days to obtain.

3) Endangered Species (Bird) Survey: Formal consultation will take a minimum of four months.

4) Cultural Resources Survey: completion of a cultural resources survey and associated documents will take between three months and one year, and may cost between $50,000-100,000.

5) USFWS Special Use Permit: A special use permit will be required for any excavation north or east of T17N R93W Sections 25,26, and 27. This permit will take a minimum of 30 days to obtain.

6) Coastal Consistency Review: the Office of Project Management and Permitting may require a coastal consistency review. This review usually takes four to six months.

Environmental Document: An Environmental Assessment is anticipated to be the appropriate level of document for either an airport expansion or relocation.

Geology / Geotechnical

Hooper Bay lies on the shore of the Bering Sea, at the edge of the extensive deltaic deposits of the Yukon and Kuskokwim drainages. Soils throughout the Y-K delta are generally composed of small particle sizes (sand and silt) originating from alluvium and eolian deposits. Gravel-sized deposits are unlikely to be found in the general vicinity. On June 23, 2004 a geotechnical field review was performed at each of the five potential airport sites. A helicopter was used to gain access at each site to perform an inspection and to hand dig shallow test holes. The following observations were made during this review:

Hooper Bay vicinity

- Terrain at the potential airport sites is considered gently rolling tundra with relief to a maximum of about 50 feet (USGS map). The general area is vegetated with mosses, lichens, low ground cover, as well as alder and willow shrubs.

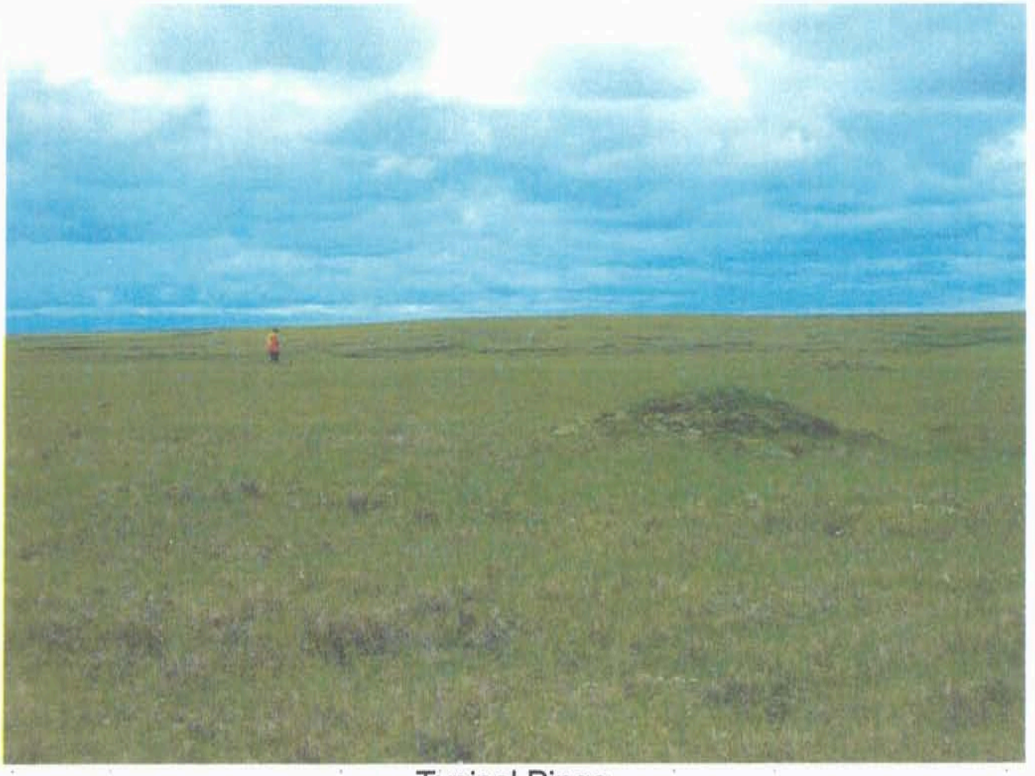
- Numerous ponds, lakes and remnant water bodies occupy lower elevations and pockets throughout the region; interconnected by numerous low volume, low gradient streams. At the time of the investigation, many of these areas appeared dryer than their normal condition, judging by watermarks and vegetation types.

- The higher portions of the tundra are dry to a depth of 4 inches then moist to wet and frozen at 8 inches, while the low-lying portions of the tundra are saturated with water at or near the surface and thawed to depths of approximately 12 inches.

- Shallow hand-auger holes revealed vegetative mat to a depth of about 4 inches, dark brown to black woody fibrous peat to 8 inches, then amorphous light brown frozen peat. Penetration was possible only to about one foot depth; further excavation with the hand auger was not possible due to frozen subsurface conditions and the limited time on-site. Mechanized equipment will be required for more detailed investigations.

- Portions of each potential site exhibited surficial frozen soil features such as pingos and peat palsas. These are ice-cored features standing above the surrounding terrain and individually small in scale.

- Pingos (as shown below) are conical features up to several feet high and six to ten feet in diameter, appearing either isolated or in dispersed clusters over the terrain. Pingos are generally formed of segregated ice just below the surface. Disruption of the thermal regime of a pingo can result in a thawing sinkhole several feet deep.



Typical Pingo

- Peat palsas (as shown in the following picture) are ice-rich peat and/or silt features, which stand above surrounding terrain by up to four feet with abrupt margins. The vegetated surfaces of palsas tend to be dryer than the immediately surrounding lowlands. Palsas can cover areas from tens of square feet to much more extensive clusters, in the range of hundreds to thousands of square feet. They were often seen clustered along shallow slopes and across low, poorly drained basins. Disruption of the thermal regimes of palsas would result in extensive areas of soft, saturated peat and organic silt muck.

Typical Palsas

- Very few soil exposures were seen. One significant exposure, encountered well beyond any of the potential alignments, consisted of a steep exposed bluff consisting of thawing silt to a height of approximately 25 to 30 feet. The bluff was slowly thawing and slumping downhill in erosive units ranging from large desk-sized blocks of silt, to thin saturated rivulets and stringers of silt.

- Due to the limited time available for the site inspection, an assessment of the coastal dunes as a possible material source could not be conducted. The soil conditions beyond the south end of the existing runway will also need to be analyzed in the event that an extension is planned for design.

<u>Material Sources</u>

As stated earlier, soils in the vicinity of Hooper Bay are likely to be frozen fine-grained sand and silt. The possibility of locating gravel in substantial quantities and reasonably close to the project is unlikely. Frozen fine-grained sand and silt can be used for embankment purposes, recognizing that transport of materials, extraction of frozen materials, entrained snow and/or ice, thawing and compaction in the embankment, and rehabilitation of a material site all pose unique problems:

- Transport overland from any distance beyond the immediate project limits will entail either road building across sensitive thaw-unstable terrain (with consequent increased quantity needs), or the establishment of a winter haul route.

- In-situ frozen silts can be extremely difficult to mine, and may require ripping equipment. Depending on the time of year when the ripping is done, surface thaw of ice-rich silts may cause liquefaction and create problems in working the site. Delays into winter and sub-zero temperatures may cause refreezing of silts.

- Compaction in the embankment is problematic in frozen, ice-rich silts, with entrained ice and snow and when those silts thaw and liquefy.

- Final configuration of a material site must be carefully planned and implemented to mitigate continuing thaw of exposed faces and siltation problems into nearby drainages.

Dunes along the Bering Sea coast are a possible source of embankment materials. The dunes provide a natural protective barrier to storm incursions inland from the coast, so a suitable location for extraction must not compromise the community and its facilities. A field inspection of the coast was not performed, but a surface sample was obtained from the dunes near the south end of the existing runway. A laboratory sieve analysis of the dune sand revealed:

- 97% passing the #50
- 4% passing the #100
- 0.1% passing the #200
- Classified as SAND (SP) light gray, dry, loose, fine grained

In 1996, an independent sample collected by the Department's Coastal Engineering Section yielded the following results:

- 96% passing the #50
- 0.7% passing the #200
- Flow rate = 55gm/sec/cm^2 (saturated at 21% moisture)

Coarse-grained surfacing material is unlikely to be available from local sources in the vicinity of the project. Likely sources are:

- Platinum tailings sources and Calista Corp. quarry
- Cape Nome rock source
- Portage Mountain quarry at Kalskag, upstream on the Kuskokwim River
- Unalaska-Dutch Harbor rock quarries (Aleut Corp)
- Scammon Bay rock sources if available and/or accessible

Design and Construction Considerations

1. Much of the region around Hooper Bay is underlain by permafrost. This condition presents the potential for thaw settlement; frost action and differential thaw subsidence. The most practical construction approach for permafrost terrain is to minimize or completely avoid soil cuts. This dictates that the runway, taxiway, apron and access road be designed as fill sections.

2. Local material sources are likely to be limited to fine-grained soils, ranging from sand to silt particle sizes. These soils can be used for embankment material, but such use is complicated by frozen conditions, ice content and compactibility problems. Due to difficulties in transporting any loads across the tundra, or building lengthy haul roads; sources might be limited to those in close proximity to the airport. More distant sites could be practical if winter haul routes are used.

3. Surfacing materials of either gravel or crushed aggregate will not be available from local sources.

Barge access is problematic at Hooper Bay. Barge landings would either be on the ocean beach, with exposure to tidal range and surf action; or in the mud flats of Hooper Bay, which is accessible to the village via a sinuous shallow, tidally dependent slough. The additional handling procedure of lightering to smaller barges would likely be needed.

Right of Way

The land surrounding Hooper Bay falls within the boundaries of the Yukon Delta National Wildlife Refuge, but is presently owned by the Sea Lion Native Corporation. The U.S. Fish and Wildlife Service owns subsurface rights north and east of T17N R93W Sections 25,26, and 27, while the Calista Corporation owns the rights south and west.

A cursory review was completed to determine conflicts between existing native allotment and the potential relocation sites. Sites 3 and 4 appeared to be the only sites with potential conflicts. All other sites appear to be free of native allotments. Allotment number 50-2001-0445 could potentially impact site 3, while allotment number 50-2001-0453 directly impacts site 4. Property plats with respect to the potential sites and the property plan for the existing facilities have been attached as Appendix VI.

Electric Utilities

According to the Hooper Bay Comprehensive Economic Development Strategy Plan, Electricity is currently being provided to the village by the Alaska Village Electric Co-op (AVEC) at a cost of 34 cents per kilowatt-hour, which is currently subsidized by power cost equalization. AVEC recently upgraded their largest facility from 557 kW to 824 kW and has the capacity to accommodate growth. AVEC is currently exploring the possibility of installing wind generation equipment as a low cost option to fuel consumption. If the project is feasible, it is expected that the towers will be constructed during the 2006 or 2007 construction season and will be located approximately 100' AGL near the village school. The proposed site will not conflict with any of the airport alternative locations. Yukon fuel currently owns the local tank farm with an approximate fuel capacity of 170,000 gallons (unleaded) and 220,000 gallons of heating fuel (#1 diesel). Other generation facilities are also in use for a total combined capacity of 2.1 MW.

The proposed airport project would include a medium intensity lighting system consisting of runway and taxiway lights, which could be activated manually or by VHF radio. A rotating beacon will also be included and will have a photocell to operate in hours of darkness. Pads will be constructed for future PAPI & REIL systems and additional airport navigational aids, such as the existing ODALS, will be evaluated based on the proposed project. The total peak demand for a new airport would be approximately 12 kW, which would be supported by the existing power generation facilities.

Coastal Engineering / Hydrology

Storm Surge Events

Storm surge events occur in the fall with storms from the south-southwest, producing large tides. An extreme high tide is 8.0-feet, mean low level water (MLLW) and the estimated 50-year storm surge is 12-feet, which would give a water elevation of about 20-foot MLLW (approximately 10-foot – National Geodetic Vertical Datum (NGVD)). This approximation of surge plus tide is reasonable since a survey completed in 2004 depicted the top of the sheet pile wall at about 9.0-feet NGVD and no sign of overtopping was present.

An obvious debris line composed of logs and abandoned vessels is visible at the toe of the numerous small hills north of Hooper Bay. This indicates the extent of flooding from storm surge events. During a field trip conducted on June 23, 2004, locals commented that the existing airport access road (as shown right) is subject to flooding from these events, which inundate the area with up to four feet of standing water. It was also learned that flooding occurs at least every two years to the extent that the road is impassible from the edge of the city to the airport. However, there is no evidence indicating that the village or airport has ever flooded. (Note: the elevation of Hooper Bay City is 35' on a USGS quad map, datum WGS84/NAD83.)

The existing airport access road presently remains as a footprint of previous construction attempts, with standing water on both sides. It is currently at or below the adjacent terrain, which is flat, wet and soft. The previous road embankment was constructed higher but was eroded by waves and scouring stemming from storm surge events. These events caused the road to fail in one season after employing traditional construction methods, with the absence of an active drainage system.

In the event that the airport is reconstructed at its present location, the road must be raised and protected from storm events to provide a road that is usable year round. Any potential design would also require active drainages because of the large volume of water passing under, through and around the embankment during such storms.

As previously mentioned, it is recommended that an interim project be constructed until a more permanent solution can be implemented. Under an interim project, a relatively inexpensive design for the access road would include 1.5' of rock of various gradations up to 8". This would allow water to flow freely through the embankment in addition to allowing overtopping during storm events. Allowing overtopping for an interim project would reduce the cost of a temporary fix. Another benefit is that the road surface would remain intact and firm after flood events have subsided. Material may need to be bladed to the center periodically since the material will tend to move outward under traffic loading.

It appears that the potential runway sites are all above the height of storm surge. However, access roads to the potential relocation sites may potentially be subject to storm surge flooding events. Once an alternative is selected, evidence of flooding (debris) within the proposed airport prisms will need to be thoroughly evaluated. It is recommended that culverts be included in the design of the runway and access roads as necessary to prevent local ponding of water.

Erosion Concerns

In addition to storm surge events and its related flooding, the existing airport is subject to beach erosion as shown right. The airport is located on coastal dunes adjacent to the Bering Sea, which has fetches hundreds of miles in length. Waves on the Bering Sea shelf exceed 30-feet. As the waves near the coast, they shoal and break

on the offshore bars. Generally, by the time they reach the beach, the waves are parallel to the shoreline and offshore bars. These waves impact the beach causing sedimentary transport. Although the sedimentary transport is bi-directional, the dominant direction is to the south. This means that the northern end of the runway will be subject to continued erosion. Presently, the northern end of the runway acts somewhat like a groin. The natural tendency of the beach would be to smooth the north end of the runway to conform to a more natural beach line.

Using aerial photography from 1951 to 1994, beach erosion rates were estimated to be three-foot per year, but appeared to slow down to about two feet per year after 1968. However, looking at a more recent 1997 photograph (shown right) and comparing it with a print from 1968, the beach has receded over 200-feet or about 8 feet per year. Changes in the rate of erosion can be due a number of issues such as the reduced sea ice, influence of the sheet pile wall acting as a groin, additional beach mining, larger storms, melting permafrost, global warming and sea level rise.

At the apparent erosion rate of 8-feet per year, erosion will have breached the ends of the sheet pile wall in another 7 to 10 years. This is depicted in the graphic shown right. The red line depicts what the beach line would be at the erosion rate of 8 feet/year. If erosion slows to the previous rate of 3 feet per year, we are looking at about 30 years. Either way, this does not provide a 50-year life.

In the event that the airport is reconstructed at its present location, erosion would affect the northwest corner of the safety area within 10 years (if the sheet pile were not in place). To provide a 50-year design life at its present location, a 400-foot buffer measured perpendicular to the beach and between the edge of the vegetated berm and the northwest corner of the proposed reconstructed runway section would be needed, assuming 8 feet of erosion per year. This would place the northwest corner of the safety area about 2,400 feet south of the sheet pile corner along the current alignment.

As mentioned in the Airport Project History section, an ArmorFlex concrete block system was constructed in 1981 to protect the bank from erosion. The ArmorFlex placed at Station 22+00 (as shown right) is stable and remains in good condition on a 3 to 1 slope. There is wild beach rye growing around the concrete armor units, which helps promote stability. However, areas with steep, non-vegetated bluffs between sections with ArmorFlex are actively eroding.

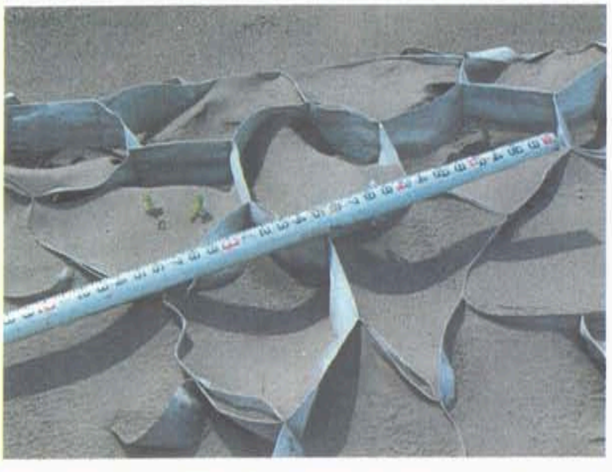
As you approach the north end of the runway, the beach slopes are less stable and erosion is evident (depicted below). The ArmorFlex mat on the north end of the runway is in a failed condition, but is still effective in stabilizing the shoreline. Barrels from the earlier project are visible under the debris as shown in the picture below.

The sheet pile wall (shown right) at the north end of the runway is in relatively good condition, with little rust present. The east-west portion of the wall appears to adequately protect the runway from the stream located just beyond the north end. However, active erosion from the Bering Sea is occurring on the beach side of the wall. Fifty percent of the wall height (about 10 feet) is visible on the north end of the runway. There is some evidence of toe scour, but no evidence of overtopping.

The remaining pavement, which extends beyond the sheet pile onto the beach, is overhanging (as shown left). The more densely packed sand beneath this asphalt is eroding more slowing than the surrounding bluff.

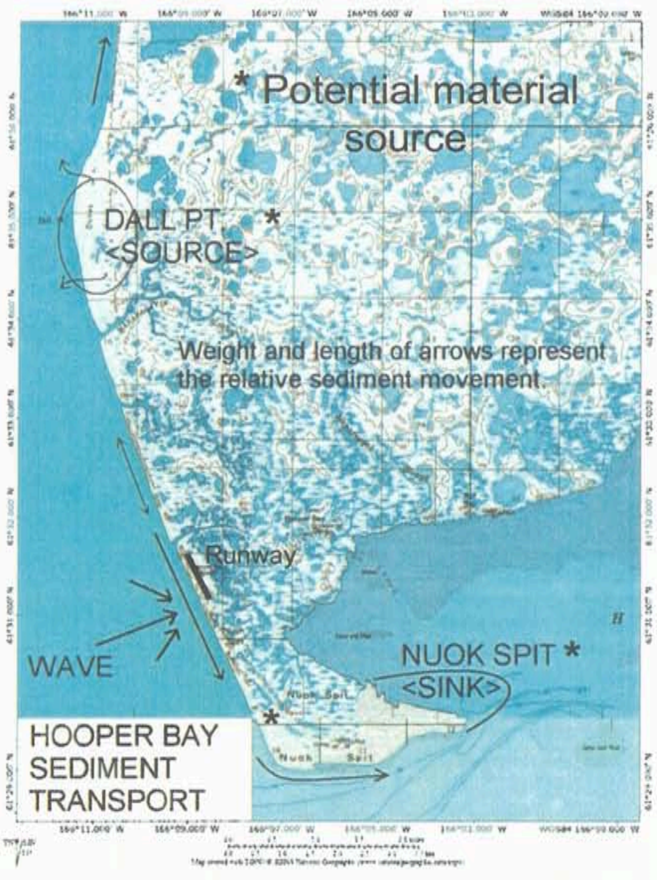
If the existing airport is reconstructed, it is recommended that either: (a) add slope stabilization to protect the sheet pile wall, or (b) ensure the sheet pile wall will be stable during the design scour event without slope stabilization.

Seeding has proved to be an effective method of controlling erosion on flat ground. Most areas replanted with wild beach rye in 1996 are doing well. A geotextile grid was used to help stabilize the sand while the rye took hold (as shown below). The only unvegitated area is on the northeast end of the runway where four wheelers access the runway. In the photo below, it can be seen how the grasses have provided a solid vegetative cover in undisturbed areas.



Material Sources

Historically, the city has mined the beach for embankment material south of the runway for construction projects. It is also assumed that local residents have removed an unknown quantity of material for various local projects. The Department of Natural Resources (DNR, Clark Cox) has issued permits for removal of 60,000 cubic yards (cy) in 1996 and 32,600 cy in 2001. Two applications (2004) are currently being processed, which include a road project (10,000 cy) and new school (22,000 cy). Removal of sediment in an active environment such as this can affect the sedimentary budget. The village has expressed similar concerns, which will be addressed in any potential design.



Over time, Nuok Spit (as shown right) will continue to grow into Hooper Bay. The sediment that forms this feature comes from the coastal dunes from Dall Point to Nuok Spit. The beach in this area lines up perpendicular to the strong southwesterly winds that occur with fall storms. Material taken from the Hooper Bay side of Nuok Spit is no longer in the sediment system. While it is likely a good source of material, it may be too far from the potential airport site to be practical.

An estimated 80-foot high bluff exists north of the potential relocation sites. This feature could be the southern extent of extreme coastal flooding events from northerlies for Kokechik Bay. It could be the remnant of an historic shoreline, or the Kokechik River could have formed it. There may be a viable material source associated with this feature. However, the proximity of this source may be too far from potential airport sites as well.

Dall Pt. (as shown right) exhibits characteristics of bi-directional transport of sediment and acts as both a sediment source and sink. Sediment moves both north and south from Dall Pt. This has potential as a material source in the event that the airport is relocated to sites 1 or 2.

Beach material parallel to the existing runway is moving south toward the spit; removal of it will have less effect on the existing runway the further south it is taken. In the event that the airport is reconstructed, it is recommended that material be mined from the beach and dunes ¾ - to 1 mile south of the existing beach access road. It is also recommended to avoid areas where there are thaw lakes near the edge of any vegetated bluff.

Design and Construction Considerations

In the near term, it is recommended that the horizontal and vertical erosion along the face of the sheet pile wall be monitored. If more of the toe is exposed sand bags may be added to minimize erosion progression. If 75% of the length of the sheet pile wall in either direction is exposed, it is recommended that wall be extended. The ArmorFlex sections should also be monitored to prevent further erosional damage to the existing facilities.

Prior to any new airport project, it is also recommended that storm surge indicators be installed to measure the maximum water elevation. This can be accomplished simply by having locals survey or mark high tide or storm surge elevations and locations with respect to a fixed datum or object. This in addition to the existing debris line will help associate any areas requiring design consideration of storm events.

If the airport is relocated, it is recommended that the sheet pile be removed to allow natural beach process to occur. If it is left in place, it may become a liability or an attractive nuisance as it deteriorates. ArmorFlex blocks can be abandoned in place, since they have been incorporated into the beach. If they are selected for removal, it is recommended that the connecting wires be cut and the blocks removed, while minimizing removal of material.

Maintenance & Operations

Hooper Bay currently has a 40' x 60' two-bay unheated snow removal equipment building, which is shown in the picture below. The building was built in 1964 and is currently included in the AIP spending plan for replacement. The plan includes a new heated 3-bay building with metal floor, which shall be located on the proposed apron.

References

The following references were used as the design standards and guidelines in preparation of this document:

AASHTO – Guidelines for Geometric Design for Very Low-Volume Local Roads (ADT<400), 2001, American Association of State Highway and Transportation Officials.

Alaska Airport Pavement Condition Report, 2003, State of Alaska, Department of Transportation and Public Facilities.

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Comprehensive Economic Development Strategy Plan, 2004, ASCG Inc.

FAA Airport Design Advisory Circulars, USDOT, Federal Aviation Administration.

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